

Congenital cystic eye with multiple dermal appendages and intracranial congenital anomalies

Ioannis Tsitouridis, Michael Michaelides, Christos Tsantiridis, Styliani Spyridi, Mary Arvanity, Ioannis Efstratiou

ABSTRACT

Congenital cystic eye (anophthalmia with cyst) is an extremely rare anomaly discovered at birth with few reported cases in the literature, resulting from partial or complete failure during invagination of the primary optic vesicle during fetal development. Herein we present the radiographic, ultrasound, and magnetic resonance imaging findings of a unique case of congenital cystic eye associated with dermal appendages and advanced intracranial congenital anomalies in a 3-month-old boy.

Key words: • congenital abnormality • eye • anophthalmos • ultrasonography • magnetic resonance imaging

Congenital cystic eye, known also as anophthalmos with cyst, is an extremely rare congenital anomaly, first described by Mann in 1939 (1). Pathogenetically, it results from an arrest in the invagination of the primary optic vesicle between the 2-mm and 7-mm stages of fetal development (2–5). Herein we present the findings of radiography, ultrasonography (US), and magnetic resonance imaging (MRI) in a unique case of congenital cystic eye associated with dermal appendages and intracranial congenital anomalies in a 3-month-old boy.

Case report

A 3-month-old boy presented to our department for investigation of a large mass in the left orbital region, which had been present since birth. The boy was well developed and was otherwise in good health. Results of screening hematology and blood biochemistry tests were within normal limits. In addition to the lesion extruding from the left orbit, a few dermal appendages of the left half of the face were also noted (Fig. 1).

The boy was delivered by caesarian section in the 38th week of pregnancy (because of maternal history of previous caesarian section), with a birth weight of 2800 g. There were no complications during pregnancy or delivery. The parents were healthy and unrelated, with no history of illness or drug ingestion during pregnancy. No family history of developmental abnormalities was mentioned by the parents, who also had a healthy 2-year-old boy. Ultrasonography during pregnancy was not performed, so the lesion was unanticipated at birth.

Physical examination demonstrated a large mass protruding from the left orbit. Both eyelids were stretched, covering the lesion. The lower eyelid was reddish and hyperemic. The mass was soft, non-tender, non-pulsatile, and cystic in consistency; the size did not change during crying. Ophthalmological evaluation of the right eye did not demonstrate any pathological findings. Systemic evaluation (except for the brain) did not reveal other abnormalities, including congenital heart disease.

Radiographs of the skull revealed a soft tissue mass of the left orbit with expansion and remodeling of the superior and lateral bony walls of the orbit (Fig. 2). No abnormalities of the chest or abdomen were noted on radiographs.

US of the left orbit demonstrated a mainly cystic lesion with a maximum diameter of about 6 cm. Within the cyst, there were a few septa; there was also a solid component with a diameter of about 2.5 cm with internal small cystic areas, and arterial and venous flow signals. No eye globe was identified in the left orbit (Fig. 3). There were no US abnormalities in the abdomen.

MRI of the orbits and the head demonstrated the lesion as well as abnormalities of the brain. The lesion was mainly cystic, with internal septa and a solid intracystic component which contained smaller cystic areas,

From the Departments of Diagnostic and Interventional Radiology (I.T., M.M. ✉ michaelidesm@yahoo.com, C.T., S.S., M.A.), and Pathology (I.E.), Papageorgiou General Hospital, Thessaloniki, Greece.

Received 16 June 2008; revision requested 17 July 2008; revision received 24 July 2008; accepted 14 August 2008.

Published online 21 October 2009
DOI 10.4261/1305-3825.DIR.2054-08.1



Figure 1. Photograph of the patient displays the mass in the left orbit and the dermal appendages on the ipsilateral side of the face.

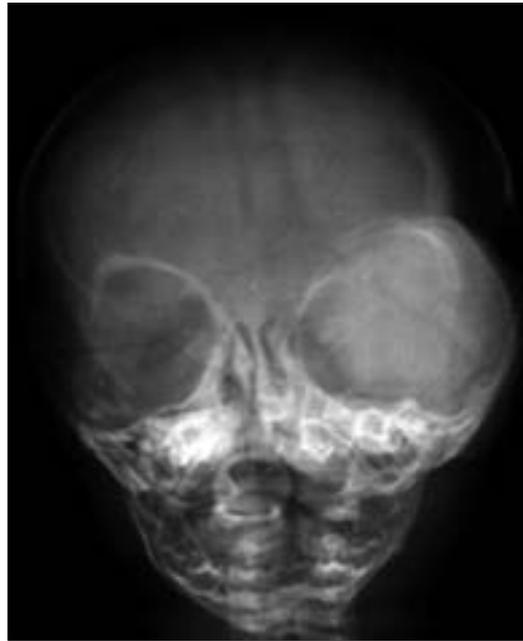


Figure 2. Anteroposterior radiograph of the skull, showing a soft-tissue shadow in the left orbit, with expansion and remodeling of the superior and lateral bony walls of the orbit.

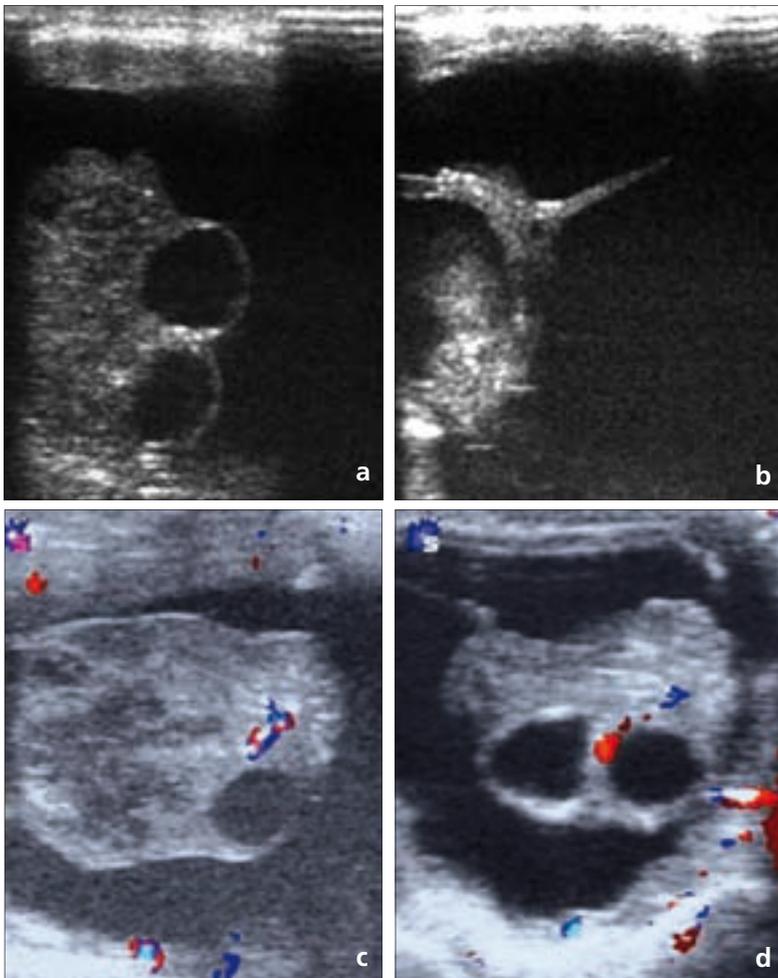


Figure 3. a–d. Gray scale US (a, b) and color Doppler US (c, d) images of the left orbit, showing the cystic nature of the lesion, with intracystic septa and a solid component that has small cystic areas and internal flow signals.

corresponding to the US findings. The wall of the cyst, the septa, and the solid component demonstrated contrast enhancement after intravenous administration of gadolinium. The intraconal part of the optic nerve was not clearly depicted by MRI, whereas the extraconal part of the optic nerve and the optic chiasm were demonstrated to have normal morphology by MRI. Extraocular muscles were also recognizable. Microphthalmos with cyst (colobomatous cyst) and teratoma were initially included in the differential diagnosis but were excluded because of the complete absence of any recognizable eye structure. These findings were suggestive for cystic eye disease (Fig. 4). Additional abnormalities included complete agenesis of the corpus callosum, colpocephaly, schizencephaly, asymmetry of the ventricular system, asymmetry of the hemispheres, interhemispheric cyst, polymicrogyria, and bands of subependymal heterotopia under the body of the left ventricle (Fig. 5).

The patient was operated on a month later for cosmetic reasons. At surgery the orbital mass was excised, and no recognizable eye structure was identified. An orbital implant was placed in the orbit. Dermal appendages were also excised. Microscopically, the cyst wall was composed of glial and fibrous tissue. Histological examination of the inner solid component revealed imma-

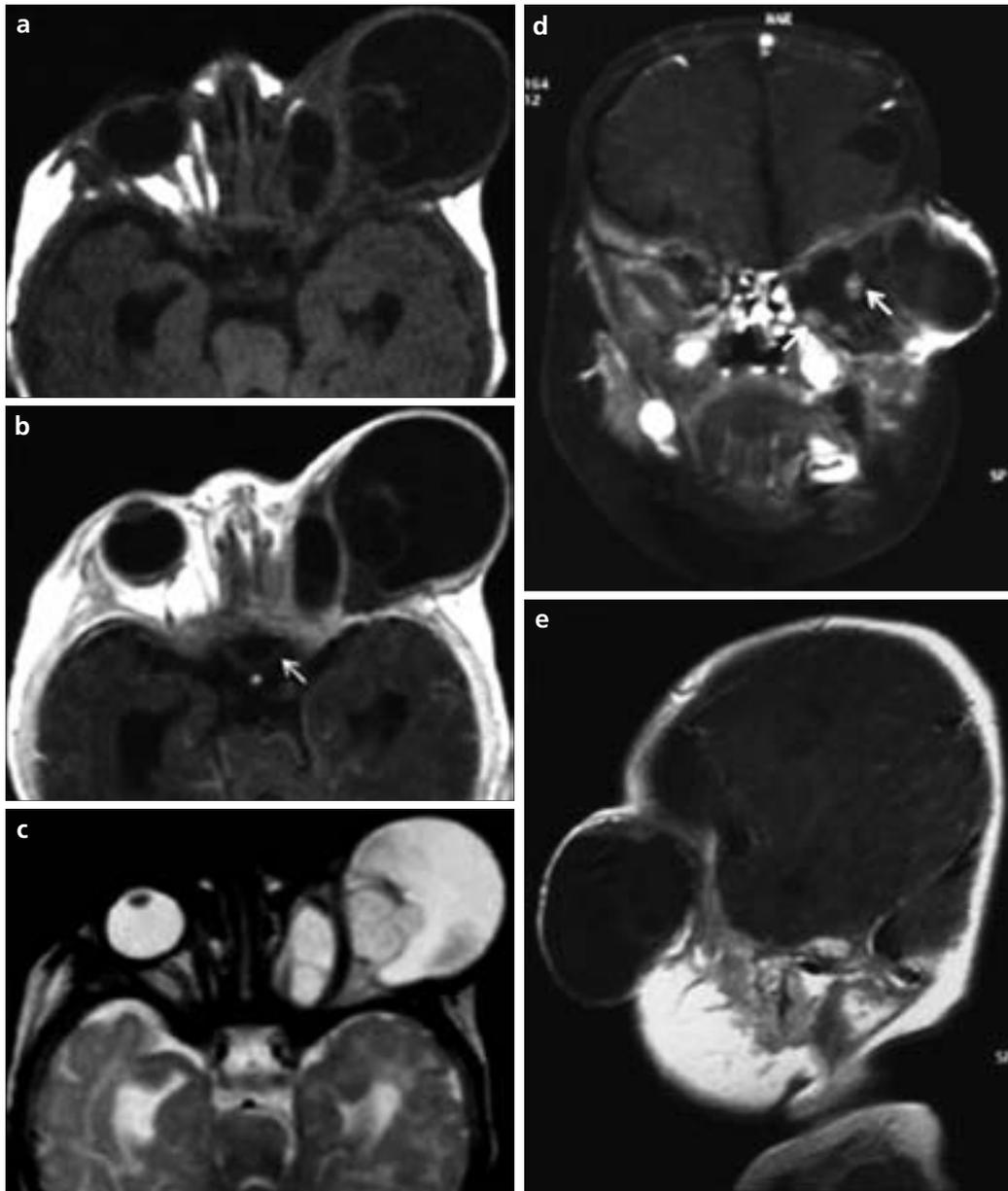


Figure 4. a–e. Axial T1-weighted (a), postcontrast T1-weighted (b), T2-weighted (c), coronal postcontrast fat suppressed T1-weighted (d), and sagittal postcontrast T1-weighted (e) MR images of the orbits show a mainly cystic lesion, with a few septa and an intracystic solid component. The wall of the cyst, the septa, and the inner solid component demonstrate contrast enhancement after intravenous administration of gadolinium. Optic chiasm and the extraconal part of the left optic nerve have normal morphology (arrow, b). The extraocular muscles are also recognizable (arrows, d).

ture neuroglial tissue and a prominent layer of melanin-containing cells, resembling a retinal pigment epithelium. Other eye structures, including the lens, vitreous chamber, and choroid were absent. The facial dermal appendages were composed of normal dermal and epidermal elements (Fig. 6). Based on imaging, surgical and histopathological findings, the final diagnosis was congenital cystic eye.

Discussion

Congenital cystic eye, or anophthalmia with cyst, is an unusual benign congenital malformation of the eye arising from failure of invagination of the primary optic vesicle between

the 2-mm and 7-mm stages of fetal development, when neuroectodermal elements are not able to develop into future eye structures. More specifically, the primary optic vesicles are formed by the anterior brain around the third week (3.2-mm stage), while during the fourth week (4.5-mm stage) these vesicles begin to invaginate in order to transform themselves into a secondary optic vesicle or optic cup. The cystic structure of the lesion represents the primitive optic vesicle that failed to undergo differentiation into its adult components. This entity is extremely rare with fewer than 40 cases reported in the literature (2–4, 6, 7).

Congenital cystic eye is discovered at the time of birth as a cystic lesion filling the orbit, located behind the upper or lower eyelid without any evidence of an eyeball (4). It is a nonhereditary, unilateral disorder of unknown origin with no gender preponderance, although two cases with bilateral congenital cystic eye have been described (8, 9). There is no evidence of chromosomal abnormality, although genetic investigations in one patient demonstrated a defect of the chromosome 13 (13q) deletion syndrome, known as Orbeli syndrome (2, 10).

Children with this anomaly may be healthy or have associated abnormalities including facial cleft, cleft

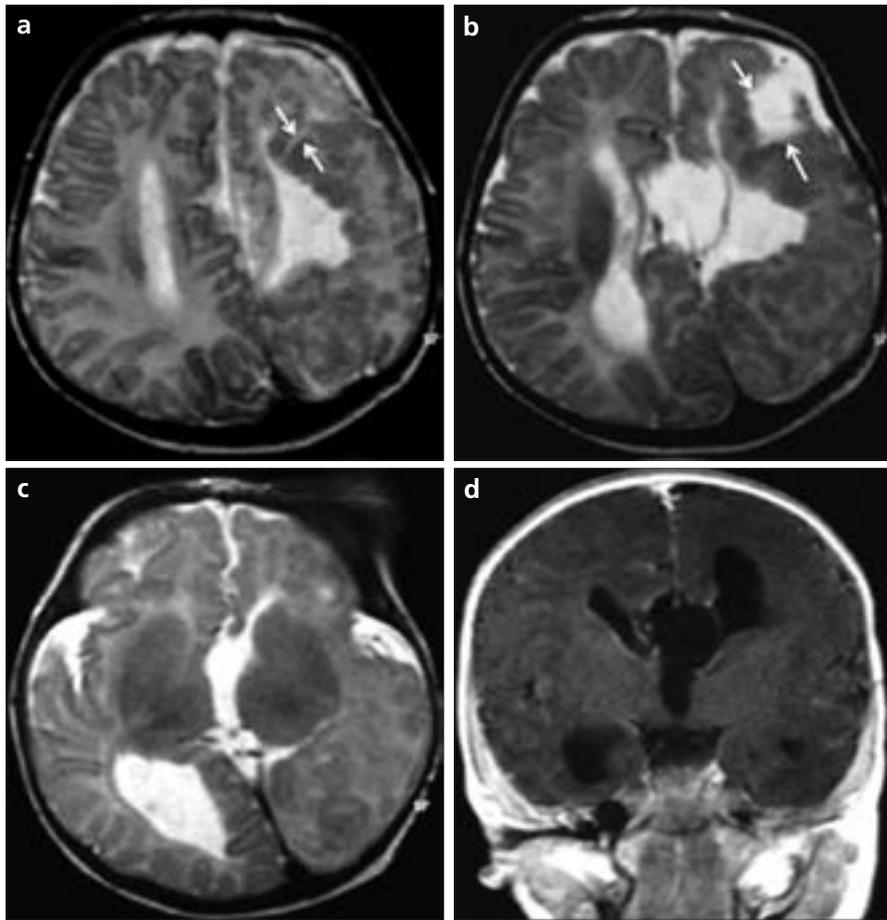


Figure 5. a–d. Axial T2-weighted (a–c), and coronal postcontrast T1-weighted (d) MR images of the brain demonstrate associated abnormalities of the brain, including complete agenesis of the corpus callosum, colpocephaly, asymmetry of the ventricular system, asymmetry of the hemispheres, interhemispheric cyst, polymicrogyria in the left hemisphere, bands of subependymal heterotopia under the body of the left ventricle, and a close-lip schizencephaly (arrows, a, b).

lip and palate, skin tags, notch, and periocular dermal appendages on the same side as the congenital cystic eye, a colobomatous eyelid defect on the opposite side, choanal atresia, saddle nose, malformation of the nostril, multiple punched-out lesions of the scalp and face, electroencephalographic abnormal signs in Rolandic area, microphthalmus with hydrocele, tetralogy of Fallot, hypoconvex fingernails on short stubby fingers, and bifid thumb (6, 8, 9, 11–16). Intracranial anomalies associated with congenital cystic eye are described in only a few papers, probably reflecting absence of advanced neuroimaging in the older cases rather than lack of intracranial anomalies. Associated intracranial anomalies include malformation of the sphenoid bone, agenesis of the corpus callosum, colpocephaly, gray matter heterotopia, holoprosencepha-

ly, basal encephalocele, microcephaly, midbrain deformities and anomalies of the central visual pathways (2, 3, 8, 9, 11–14, 17).

The contralateral eye in most cases is normal, although a case of high myopia, a case of microphthalmos with cyst, and a case of non-persistent hyperplastic primary vitreous of the contralateral eye have been reported (2, 11, 13). Although the lesion does not move like a normal eye, the extraocular muscles may be attached to the mass in a normal or anomalous pattern (4).

MRI features of this entity are described separately in case reports. In general, a complex protruding, mainly cystic mass that is present since birth fills and expands the orbit. Cystic parts of the lesion are hypointense on T1-weighted images and hyperintense on T2-weighted images, similar to vit-

reous or cerebrospinal fluid, whereas solid components of the lesion are isointense to muscle on T1-weighted images and enhance more than normal brain parenchyma after intravenous administration of gadolinium. No recognizable eye structure is demonstrated. There is no intracranial communication of the cyst. An optic nerve stalk may be found posterior to the lesion or may be absent. The optic chiasm may be malformed. Extraocular muscles may be difficult to differentiate. Other associated intracranial anomalies may be also demonstrated by MRI (2–5).

Differential diagnosis from other cystic lesions of the orbit should be based mainly on the absence of any recognizable eye structure within the orbit, which is filled with and expanded by a cystic lesion. Differential diagnosis includes other neural cysts of the orbit, teratomatous cyst (teratoma), and lymphangioma.

There are two kinds of neural cysts of the orbit: neural cysts associated with ocular maldevelopment and neural cysts associated with neural and meningeal tissue. Congenital cystic eye and microphthalmos with cyst are included in the first category, while cephalocele, ectopic brain tissue, and optic nerve meningocele are included in the second (4, 5). In microphthalmos with cyst (colobomatous cyst), which is much more common, a small but recognizable eye that contains normal eye structures (cornea, iris, ciliary body, lens, vitreous cavity, retina, and choroid) is found.

The cyst arises from failed closure of the fetal fissure, corresponding to the 7-mm and 14-mm stages of fetal development; it usually enlarges inferiorly, displacing the lower eyelid. Histopathologically, the cystic portion of microphthalmos with cyst is similar to congenital cystic eye (4, 9, 14). In cephalocele, which is very rare in the orbit, brain tissue protrudes in the orbit through a bony defect. Ectopic brain tissue (heterotopia) has the same neural constituents as cephalocele, although there is no demonstrable connection to the brain (5, 18). Orbital optic nerve meningocele, known also as optic nerve sheath cyst, is a fluid-filled expansion of the subarachnoid or/and subdural space (4). Orbital teratoma is a rare embryonic tumor that contains histologic structures of the three em-

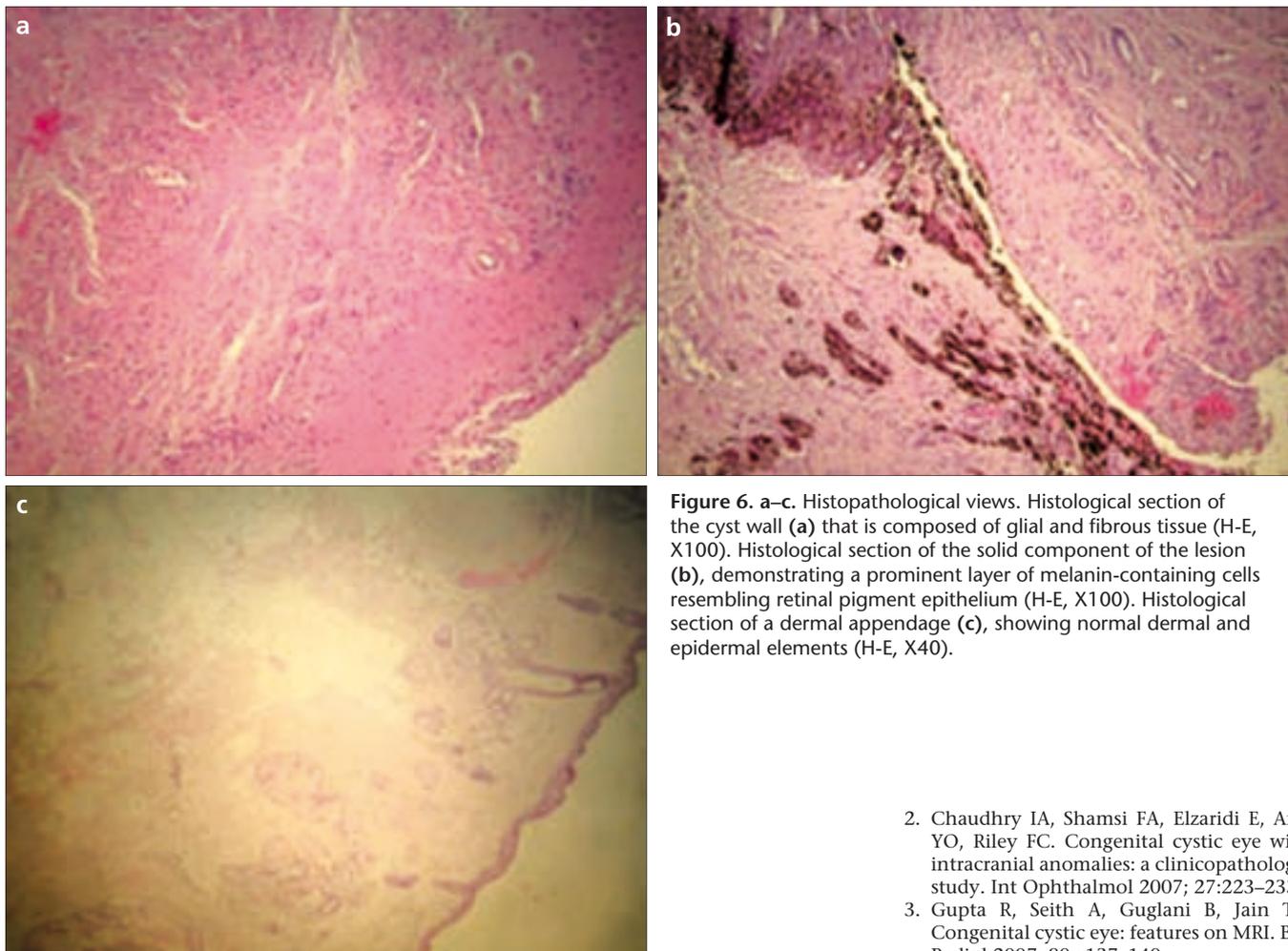


Figure 6. a–c. Histopathological views. Histological section of the cyst wall (a) that is composed of glial and fibrous tissue (H-E, X100). Histological section of the solid component of the lesion (b), demonstrating a prominent layer of melanin-containing cells resembling retinal pigment epithelium (H-E, X100). Histological section of a dermal appendage (c), showing normal dermal and epidermal elements (H-E, X40).

bryonic germ layers. The eye is usually normally developed, but often vision is not preserved due to either exposure or secondary optic atrophy. Solid and cystic components, fat, coarse calcifications, and large enhancing blood vessels may be found. In large lesions, the globe may be severely compressed (4, 19). Lymphangioma (venous-lymphatic malformation) in the orbit is an anomaly of venous and lymphatic development that is characterized by nonenhancing cystic lymphatic and enhancing solid venous components (4, 20).

On microscopic examination, congenital cystic eye is usually lined by a dense fibrous connective tissue resembling sclera, to which skeletal muscle and adipose tissue are attached. Immature retinal tissue usually lines the inner aspect of the cyst. Because of a developmental failure of the lens placode, the lens is always absent. Posteriorly, an optic nerve-like structure is

found, consisting of fibrous astrocytes without neurons (2, 4, 21).

Surgical removal of the lesion with placement of a ball implant is usually performed for cosmetic reasons.

In conclusion, although congenital cystic eye is usually discovered at birth, diagnosis is established during surgery demonstrating complete absence of a recognizable eye structure. Imaging modalities, especially MRI, are crucial for the preoperative planning of these lesions and can identify other associated intracranial anomalies that are important for the future mental development of the child. To our knowledge, this is the first reported case of congenital cystic eye with associated dermal appendages and intracranial congenital abnormalities.

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